



BSI Standards Publication

Safety requirements for electrical equipment for measurement, control, and laboratory use

Part 2-201: Particular requirements for control equipment

National foreword

This British Standard is the UK implementation of EN IEC 61010-2-201:2024. It is identical to IEC 61010-2-201:2024. It supersedes BS EN IEC 61010-2-201:2018, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/65, Measurement and control.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2024
Published by BSI Standards Limited 2024

ISBN 978 0 539 04521 5

ICS 13.110; 17.020; 19.020; 25.040.40

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2024.

Amendments/corrigenda issued since publication

Date	Text affected
<hr/>	

English Version

Safety requirements for electrical equipment for measurement,
control, and laboratory use - Part 2-201: Particular requirements
for control equipment
(IEC 61010-2-201:2024)

Exigences de sécurité pour appareils électriques de
mesurage, de régulation et de laboratoire - Partie 2-201:
Exigences particulières pour les équipements de
commande
(IEC 61010-2-201:2024)

Sicherheitsbestimmungen für elektrische Mess-, Steuer-,
Regel- und Laborgeräte - Teil 2-201: Besondere
Anforderungen für Steuer- und Regelgeräte
(IEC 61010-2-201:2024)

This European Standard was approved by CENELEC on 2024-11-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 65/1049/FDIS, future edition 3 of IEC 61010-2-201, prepared by TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61010-2-201:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-11-30
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-11-30

This document supersedes EN IEC 61010-2-201:2018 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 61010-2-201:2024 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 61010-1:2010	NOTE	Approved as EN 61010-1:2010 (not modified)
IEC 61010-1:2010/A1:2016	NOTE	Approved as EN 61010-1:2010/A1:2019
IEC 60364-4-41	NOTE	Approved as HD 60364-4-41
IEC 60664-1	NOTE	Approved as EN IEC 60664-1
IEC 60715	NOTE	Approved as EN 60715
IEC 60721-2-3	NOTE	Approved as EN 60721-2-3
IEC 60947-1:2020	NOTE	Approved as EN IEC 60947-1:2021 (not modified)
IEC 61051-2	NOTE	Approved as EN IEC 61051-2
IEC 61131 series	NOTE	Approved as EN IEC 61131 series
IEC 61131-6	NOTE	Approved as EN 61131-6
IEC 61140:2016	NOTE	Approved as EN 61140:2016 (not modified)
IEC 61643 series	NOTE	Approved as EN IEC 61643 series
IEC 61643-21	NOTE	Approved as EN 61643-21

IEC 61643-311	NOTE	Approved as EN 61643-311
IEC 61643-321	NOTE	Approved as EN 61643-321
IEC 61643-331	NOTE	Approved as EN IEC 61643-331
IEC 61800 series	NOTE	Approved as EN 61800 series
IEC 62133 series	NOTE	Approved as EN 62133 series
IEC 62368 series	NOTE	Approved as EN IEC 62368 series

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Annex ZA of EN 61010-1:2010 and EN 61010-1:2010/A1:2019 is applicable, except as follows.

Add the following references:

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60384-14	-	Fixed capacitors for use in electronic equipment - Part 14: Sectional specification - Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	EN IEC 60384-14	-
IEC 60695-2-11	-	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end products (GWEPT)	EN IEC 60695-2-11	-
IEC 60695-11-3	-	Fire hazard testing - Part 11-3: Test flames - 500 W flames - Apparatus and confirmational test methods	EN 60695-11-3	-
IEC 60695-11-20	-	Fire hazard testing - Part 11-20: Test flames - 500 W flame test method	EN 60695-11-20	-
IEC 60947-4-1	-	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters	EN IEC 60947-4-1	-
IEC 60947-4-2	-	Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters - Semiconductor motor controllers, starters and soft-starters	EN IEC 60947-4-2	-
IEC 60947-5-1	2016	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices	EN 60947-5-1	2017

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61010-1	2010	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements	EN 61010-1	2010
+ A1 (mod)	2016		+ A1	2019
			+ AC	2019-04
IEC 61010-2-030	-	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits	EN IEC 61010-2-030	-
IEC 61810-1	2015	Electromechanical elementary relays - Part 1: General and safety requirements	EN 61810-1	2015

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope and object.....	8
2 Normative references	10
3 Terms and definitions	10
4 Tests	13
5 Marking and documentation.....	14
6 Protection against electric shock	17
7 Protection against mechanical HAZARDS.....	31
8 Resistance to mechanical stresses	32
9 Protection against the spread of fire	34
10 Equipment temperature limits and resistance to heat.....	39
11 Protection against HAZARDS from fluids and solid foreign objects	45
12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure	45
13 Protection against liberated gases and substances, explosion and implosion	46
14 Components and subassemblies	46
15 Protection by interlocks	50
16 HAZARDS resulting from application	50
17 RISK assessment.....	50
Annexes	51
Annex E (informative) Guidelines for reduction of POLLUTION DEGREES	52
Annex F (normative) ROUTINE TESTS	54
Annex L (informative) Index of defined terms	56
Annex AA (informative) General approach to safety for control equipment	57
Annex BB (informative) System drawing of isolation boundaries	60
Annex CC (informative) Historical techniques for secondary circuits	71
Annex DD (normative) Flammability test for magnesium alloy fire ENCLOSURES or flame barriers (see 9.3.2)	75
Annex EE (informative) Information and documentation and correlation to their uses.....	76
Annex FF (informative) Measurement of CLEARANCES and CREEPAGE DISTANCES.....	78
Bibliography.....	80
Figure 101 – Typical INTERFACE/PORT of control equipment	19
Figure 102 – Examples of insulation between separate circuits and between circuits and ACCESSIBLE conductive parts	24
Figure 103 – Mechanical HAZARDS, with regard to PANEL MOUNTED EQUIPMENT	31
Figure 104 – Spread of fire HAZARDS, with regard to PANEL MOUNTED EQUIPMENT.....	35
Figure 12 – Baffle	37
Figure 13 – Area of the bottom of an ENCLOSURE to be constructed as specified in 9.3.2 c) 1).....	38
Figure 105 – General temperature test environment	41
Figure 106 – Vented equipment	42

Figure 107 – Non-vented equipment	43
Figure 108 – PANEL MOUNTED EQUIPMENT extending through the wall of the end location ENCLOSURE	44
Figure AA.1 – Control equipment access and safety concerns	57
Figure BB.1 – Typical system ENCLOSURE layout	60
Figure BB.2 – Simplified system schematic	62
Figure BB.3 – HAZARD situation of the control equipment	63
Figure BB.4 – Application of IEC 61010-2-201 to the control equipment safety drawing	64
Figure BB.5 – Application of 6.7.1.5 items a) and b) to the control equipment safety drawing	64
Figure BB.6 – Application of 6.7.1.5 items a), b), c) and d) to the control equipment safety drawing	65
Figure BB.7 – REINFORCED INSULATION	66
Figure BB.8 – BASIC INSULATION	67
Figure BB.9 – REINFORCED INSULATION, BASIC INSULATION and impedance	68
Figure BB.10 – REINFORCED INSULATION from external power supplies	69
Figure BB.11 – BASIC INSULATION from external power supplies	70
Figure EE.1 – Information and documentation for component products	76
Figure EE.2 – Information and documentation accumulation and segregation tree for an example installation	77
Figure FF.1 – Path of a component mounted to a PWB (side view)	79
Figure FF.2 – Path of a component mounted to a PWB (side view)	79
Table 101 – INTERFACES, PORTS AND TERMINALS considered as OPERATOR ACCESSIBLE for OPEN and ENCLOSED EQUIPMENT	18
Table 3 – Multiplication factors for clearances of equipment rated for operation at altitudes up to 5 000 m	25
Table 4 – CLEARANCE and CREEPAGE DISTANCES for MAINS CIRCUITS of OVERVOLTAGE CATEGORY II up to 300 V	27
Table 5 – Test voltages for solid insulation between MAINS and between MAINS and secondary circuits OVERVOLTAGE CATEGORY II up to 300 V	28
Table 6 – CLEARANCES and test voltages for secondary circuits derived from MAINS CIRCUITS of OVERVOLTAGE CATEGORY II up to 300 V	29
Table 16 – Acceptable perforation of the bottom of an ENCLOSURE	36
Table 19 – Surface temperature limits, under NORMAL CONDITION	39
Table 102 – Overload and endurance test voltages	47
Table 103 – Overload test circuit values	49
Table 104 – Endurance test circuit values	50
Table E.1 – Environmental situations	52
Table E.2 – Reduction of POLLUTION DEGREES (PD)	53
Table CC.1 – Limits of output current and output power for inherently limited power sources	74
Table CC.2 – Limits of output current, output power and RATINGS for over-current protective devices for non-inherently limited power sources	74
Table FF.1 – Dimensions of X	78

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT
FOR MEASUREMENT, CONTROL, AND LABORATORY USE –****Part 2-201: Particular requirements for control equipment**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61010-2-201 has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) 1.1.1: the related equipment included in the Scope has been clarified;
- b) 4.3.2.101: the optical fibre module has been deleted;
- c) 5.4.3: equipment installation has been clarified;

- d) 6.7.1.1: revision of the figure representing insulation between separate circuits has been included;
- e) 6.7.101: the subclause relating to insulation for FIELD WIRING TERMINALS of OVERVOLTAGE CATEGORY II with a nominal voltage up to 1 000 V has been deleted;
- f) 6.7.1.101: a new subclause relating to insulation for SELV/PELV CIRCUITS has been included;
- g) 6.8.3: specification of voltage tester has been added;
- h) 6.9.3: an additional exception relating to colour coding has been included;
- i) 6.9.101: a new subclause relating to wiring for secondary circuits e.g. SELV/PELV has been included;
- j) 8.2.2.101: additional requirements for glass displays have been included;
- k) 8.3: the subclause relating to the drop test has been removed;
- l) 9.3.2: additional requirements for material of connectors and insulating material have been included;
- m) The particular requirements for non-metallic material have been clarified;
- n) Clause 11: the particular requirements for protection against HAZARDS from fluid and solid foreign objects have been removed;
- o) 12.4: an additional subclause relating to microwave radiation has been included;
- p) 14.102: the description of switching devices has been clarified;

The text of this International Standard is based on the following documents:

Draft	Report on voting
65/1049/FDIS	65/1095/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61010 series, published under the general title *Safety requirements for electrical equipment for measurement, control, and laboratory use*, can be found on the IEC website.

This document is to be used in conjunction with IEC 61010-1:2010, and IEC 61010-1:2010/AMD1:2016.

This document supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that publication into the IEC standard: *Particular requirements for control equipment*.

Where a particular subclause of IEC 61010-1 is not mentioned in this document, that subclause applies as far as is reasonable. Where this document states "addition", "modification", "replacement", or "deletion", the relevant requirement, test specification or note in IEC 61010-1 should be adapted accordingly.

In this document,

a) the following print types are used:

- requirements and definitions: in roman type;
- NOTES: in smaller roman type;
- *conformity and tests: in italic type*;
- terms used throughout this document which have been defined in Clause 3: SMALL ROMAN CAPITALS.

b) subclauses, figures, tables and notes which are additional to those in IEC 61010-1 are numbered starting from 101. Additional annexes are lettered starting from AA and additional list items are lettered from aa).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 61010-2-2xx documents are a series of standards on the safety of industrial-process measurement, control and automation equipment.

This document specifies the complete safety related requirements and related tests for control equipment (e.g. programmable controller (PLC), the components of distributed control systems (DCS), I/O devices, human machine interface (HMI)).

Safety terms of general use are defined in IEC 61010-1. More specific terms are defined in each relevant part of the IEC 61010 series.

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE –

Part 2-201: Particular requirements for control equipment

1 Scope and object

IEC 61010-1:2010, Clause 1 and IEC 61010-1:2010/AMD1:2016, Clause 1 apply, except as follows:

1.1.1 Equipment included in scope

Replacement:

Replace the existing text with the following:

This part of IEC 61010 specifies safety requirements and related verification tests for control equipment or their associated peripherals, or both.

Some equipment examples are:

- programmable logic controller (PLC);
- programmable automation controller (PAC);
- distributed control systems (DCS);
- industrial PC (computers) and panel PC;
- programming and debugging tools (PADTs);
- displays and human-machine interfaces (HMI);
- any product performing the function of control equipment or their associated peripherals, or both;
- positioners; and
- control equipment which have as their intended use the command and control of machines, automated manufacturing and industrial processes, for example discrete and continuous control.

Components of the above named equipment and within the scope of this document are, for example:

- (auxiliary) stand-alone power supplies;
- peripherals such as digital and analogue I/O,
- remote-I/O;
- industrial network equipment, embedded or stand-alone (e.g. switches, routers, wireless base station).

Control equipment and their associated peripherals are intended to be used in an industrial environment. This document considers equipment designed as OPEN or ENCLOSED EQUIPMENT.

NOTE 1 Control equipment intended also for use in other environments or for other purposes (example: for use in building installations to control light or other electrical installations, or for use on cars, trains or ships) can have additional conformity requirements defined by the safety standard(s) for these applications. These requirements can involve for example: insulation, spacings and power restrictions.

NOTE 2 Computing devices and similar equipment within the scope of the IEC 60950 series or the IEC 62368 series and conforming to their requirements are considered to be suitable for use with control equipment within the scope of this document. However, some of the requirements of the IEC 60950 series for resistance to moisture and liquids are less stringent, IEC 61010-1:2010, 5.4.4, second paragraph takes this aspect into account.

Control equipment covered in this document is typically intended for use in OVERVOLTAGE CATEGORY II (IEC 60664-1) in low-voltage installations, where the RATED equipment supply voltage does not exceed 1 000 V a.c. RMS (50/60 Hz), or 1 000 V d.c..

Where control equipment is intended for installation to supply systems with OVERVOLTAGE CATEGORY III or IV, additional requirements are identified in Annex K.

The requirements of ISO/IEC Guide 51 and IEC Guide 104, as they relate to this part of IEC 61010, are incorporated herein.

1.1.2 Equipment excluded from scope

Replacement:

Replace the existing text with the following:

This document does not deal with aspects of the overall automated system, for example a complete assembly line. Control equipment (e.g. DCS and PLC), their application programme and their associated peripherals are considered as components (components in this context are items which perform no useful function by themselves) of an overall automated system.

Since control equipment (e.g. DCS and PLC) are component devices, safety considerations for the overall automated system including installation and application are beyond the scope of this document. Refer to the IEC 60364 series or applicable national and local regulations for electrical installation and guidelines.

1.2.1 Aspects included in scope

Replace the first sentence with the following:

The purpose of the requirements of this document is to ensure that all HAZARDS to the OPERATOR, SERVICE PERSONNEL and the surrounding area are reduced to a tolerable level.

NOTE By using the terms "OPERATOR" and "SERVICE PERSONNEL" this document considers the perception of HAZARDS depending on training and skills. Annex AA provides a general approach in this regard.

1.2.2 Aspects excluded from scope

Replacement:

Replace the existing text with the following:

This document does not cover:

- a) reliability, functionality, performance, or other properties of the control equipment not related to safety;
- b) mechanical or climatic requirements for operation, transport or storage;
- c) EMC requirements (see e.g. the IEC 61326 series or IEC 61131-2);
- d) protective measures for explosive atmospheres (see e.g. the IEC 60079 series);
- e) functional safety (see e.g. the IEC 61508 series, IEC 61131-6).

2 Normative references

IEC 61010-1:2010, Clause 2 and IEC 61010-1:2010/AMD1:2016, Clause 2 apply, except as follows:

Addition:

Add the following new references:

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end products (GWEPT)*

IEC 60695-11-3, *Fire hazard testing – Part 11-3: Test flames – 500 W flames – Apparatus and confirmational test methods*

IEC 60695-11-20, *Fire hazard testing – Part 11-20: Test flames – 500 W flame test method*

IEC 60947-4-1, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60947-4-2, *Low-voltage switchgear and controlgear – Part 4-2: Contactors and motor-starters – Semiconductor motor controllers, starters and soft-starters*

IEC 60947-5-1:2016, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*
IEC 61010-1:2010/AMD1:2016

IEC 61010-2-030, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for equipment having testing or measuring circuits*

IEC 61810-1:2015, *Electromechanical elementary relays – Part 1: General and safety requirements*

3 Terms and definitions

IEC 61010-1:2010, Clause 3 applies, except as follows:

3.1.3

PORTABLE EQUIPMENT

Modification:

Replace the definition with the following:

equipment intended to be carried by hand and not fixed during NORMAL USE

3.2.3**PROTECTIVE CONDUCTOR TERMINAL**

Modification:

Replace the term "PROTECTIVE CONDUCTOR TERMINAL" with "PROTECTIVE EARTH TERMINAL" and add the following Note to entry:

Note 1 to entry: PROTECTIVE EARTH TERMINAL is most familiar to industrial users, manufacturers, etc. Therefore since this document is targeted towards industrial use, the most familiar term is utilized.

3.2.4**ENCLOSURE**

Replacement:

Replace the definition and NOTE with the following:

housing affording the type and degree of protection suitable for the intended application

[SOURCE: IEC 60050-151:2001, 151-13-08]

Add the following new terms and definitions:

3.101**AMBIENT TEMPERATURE**

temperature, determined under specified conditions, of the air surrounding the equipment

3.102**ENCLOSED EQUIPMENT**

equipment which includes an ENCLOSURE, having safety capability, or a combination of an ENCLOSURE, having safety capability, and installation provisions enclosing on all sides, with the possible exception of its mounting surface, to prevent personnel from accidentally touching HAZARDOUS LIVE, hot or moving parts contained therein and meeting requirements of mechanical strength, flammability, and stability (where applicable)

EXAMPLE HAND-HELD EQUIPMENT.

Note 1 to entry: This definition is related to IEC 60050-441:1984, 441-12-02.

3.103**FIELD WIRING**

wiring of the control equipment, which is not installed in the control equipment manufacturer's facility

EXAMPLE MAINS supply wiring.

3.104**INTERFACE**

shared boundary between one control equipment and another control equipment, or between parts of a control equipment, through which information or electrical energy is conveyed

[SOURCE: IEC 61131-2:2017, 3.1.21]

3.105

MODULAR EQUIPMENT

equipment consisting of different modules such as a Rack, CPU, different I/O-modules, network modules

Note 1 to entry: MODULAR EQUIPMENT can:

- a) be OPEN EQUIPMENT or ENCLOSED EQUIPMENT;
- b) consist of modules that cannot operate alone or of a basic module that is operational alone and can be enhanced in function by additional modules;
- c) vary in size and functionality depending on the combination and the number of modules;
- d) be combined with operational equipment or enhanced in function by the addition of modules by the customer.

3.106

OPEN EQUIPMENT

equipment which does not protect personnel from accidentally touching HAZARDOUS LIVE or moving parts contained therein nor meet requirements of mechanical strength, flammability and stability (where applicable)

Note 1 to entry: See Annex AA.

3.107

PANEL MOUNTED EQUIPMENT

equipment where a portion of the equipment may form part of the ENCLOSURE

Note 1 to entry: See Figure 103.

3.108

PORT

access to a device or network where electromagnetic energy or signals may be supplied or received or where the device or network variables may be observed or measured

Note 1 to entry: PORT is most commonly used with respect to EMC.

3.109

PROTECTIVE EXTRA-LOW VOLTAGE CIRCUIT

PELV CIRCUIT

protective earth referenced electrical circuit in which the voltage cannot exceed the following:

NORMAL CONDITION and SINGLE FAULT CONDITION: The a.c. voltage levels are 30 V RMS, 42,4 V peak and the d.c. voltage level is 60 V. For equipment intended for use in WET LOCATIONS, the a.c. voltage levels are 16 V RMS, 22,6 V peak and the d.c. voltage level is 35 V

Note 1 to entry: Transients are not taken into consideration in PELV CIRCUITS.

[SOURCE: IEC 60050-195:2021, 195-06-29, modified – In the preferred term, "system" has been replaced with "circuit", a full description and clarifications have been added and the Note to entry has been replaced with a new Note to entry.]

3.110

SAFETY EXTRA-LOW VOLTAGE CIRCUIT

SELV CIRCUIT

non-protective earth referenced electrical circuit in which the voltage cannot exceed the following:

NORMAL CONDITION and SINGLE FAULT CONDITION: The a.c. voltage levels are 30 V RMS, 42,4 V peak and the d.c. voltage level is 60 V. For equipment intended for use in WET LOCATIONS, the a.c. voltage levels are 16 V RMS, 22,6 V peak and the d.c. voltage level is 35 V

Note 1 to entry: Transients are not taken into consideration in SELV CIRCUITS.

[SOURCE: IEC 60050-195:2021, 195-06-28, modified – In the preferred term, "system" has been replaced with "circuit", a full description and clarifications have been added and the Note to entry has been replaced with a new Note to entry.]

3.111

SERVICE PERSONNEL

person who is installing, changing or repairing the control equipment, with the appropriate technical training, experience and awareness of HAZARDS and of measures to minimize danger to themselves, other persons or to the control equipment, in an industrial environment

Note 1 to entry: SERVICE PERSONNEL are persons having the appropriate technical training and experience necessary to be aware of HAZARDS – e.g. electrical HAZARDS, temperature HAZARDS, fire HAZARDS – to which they are exposed in performing a task and of measures to minimize danger to themselves or to other persons or to the control equipment, in an industrial environment.

Note 2 to entry: SERVICE PERSONNEL change or repair control equipment e.g. hardware configuration or installation of software updates provided by the manufacturer.

Note 3 to entry: See AA.1.3 for more detail.

4 Tests

IEC 61010-1:2010, Clause 4 and IEC 61010-1:2010/AMD1:2016, Clause 4 apply, except as follows:

4.1 General

Add the following three paragraphs of requirements after the third paragraph of requirements, before the first conformity statement:

The product is verified in accordance with this document in a documented test configuration, which represents the least favourable configuration. See 4.3.

It is likely or possible that there are different test configurations which yield least favourable test conditions. For example there can be a least favourable configuration for the temperature test, and a different least favourable test configuration for the voltage test. If this is the case then the appropriate least favourable test configuration(s) shall be used with regard to 4.3.2 and 4.4.

These least favourable test configurations and test conditions shall be practical and useful for the intended applications.

Add the following conformity statement at the end of the list of conformity statements:

Conformity verification: The selected test configuration(s) and test conditions shall be documented with the rationale in the test report.

4.4.1 General

Add the following note to item a):

NOTE A fault condition can include open or short circuit of components, as well as disabling or bridging one means or layer of protection.

4.4.4.3 Spread of fire

Add the following to the conformity statement:

Optionally, for OPEN EQUIPMENT:

The equipment may be placed inside a wire mesh cage covered with cheesecloth. The wire mesh cage shall be maximum 1,5 times the size (length, width, height) of the device or representative system including the device, to simulate the intended ENCLOSURE during the single fault condition testing. See 10.4.1.101 for representative system methodology. with a tolerance of

The wire mesh cage shall be a metal screen with a mesh 25 mm × 25 mm with a tolerance of 5 mm, centre to centre with a wire diameter of 0,8 mm ± 0,3 mm.

NOTE 1 The wire mesh used is commonly known as chicken wire, 25 mm hexagonal mesh weave made of 0,81 gauge wire.

Cheesecloth is a bleached cotton cloth of approximately 40 g/m² containing no flame retardants.

NOTE 2 Cheesecloth is a coarse, loosely woven cotton gauze, originally used for wrapping cheese.

NOTE 3 Panel mounted equipment can combine the two methods.

5 Marking and documentation

IEC 61010-1:2010, Clause 5 and IEC 61010-1:2010/AMD1:2016, Clause 5 apply, except as follows:

5.1.3 MAINS supply

Replace line 14 of Table 1 with the following:

14		ISO 7000-0434A: 2004-01 or ISO 7000-0434B: 2004-01	Caution
----	---	--	---------

IEC

5.1.5.2 TERMINALS

Modification:

Replace item a) as follows:

- a) FUNCTIONAL EARTH TERMINALS (i.e. used for non-safety purposes such as interference immunity improvement) shall be marked with one of the following symbols:



IEC 60417-5018 (2011-07) or



IEC 61010-1:2010, symbol 5 of Table 1, IEC 60417-5017 (2006-08).

Where a TERMINAL serves both as the PROTECTIVE CONDUCTOR TERMINAL and as a FUNCTIONAL EARTH TERMINAL, symbol 6 of Table 1 and other requirements for PROTECTIVE CONDUCTOR TERMINAL shall be applied. Where a TERMINAL serves both as an earth (ground) TERMINAL and FUNCTIONAL EARTH TERMINAL, symbol 5 of Table 1 and other requirements for earth TERMINALS shall be applied.

Addition:

Add the following new item after d):

- aa) If a TERMINAL has a hazardous voltage level, the TERMINAL shall be marked with symbol 14 of Table 1.

5.1.8 FIELD WIRING TERMINAL boxes

Addition:

Add the following new text after the first paragraph:

A FIELD WIRING TERMINAL need not be marked to indicate the temperature RATING if it is intended for the connection of a control circuit conductor only.

A control circuit is any circuit that does not carry MAINS power and is generally limited to 15 A.

5.4.1 General

Addition:

Add the following new text:

For equipment intended to be installed by SERVICE PERSONNEL or trained installers, all documentation may be provided by electronic media.

Where the documentation is provided by electronic media, this may be accomplished by including symbol 14 of Table 1, on the product, and the location of the documentation, for example URL, QRcode, on the product, packaging or printed information with the product.

Annex EE provides details on the flow of information, regarding safety aspects, for controls and its accessory in an industrial use.

5.4.2 Equipment RATINGS

Addition:

Add the following new items:

- aa) digital input devices shall be rated in volts and shall also indicate whether the input device is intended for direct or alternating current;*
- bb) analogue input and analogue output devices shall be rated in the voltage range or current range, or both, as applicable;*
- cc) digital and switching output devices shall be rated in voltage and one or more of the following depending on intended load type:*
 - 1) general purpose: amperes;*
 - 2) coil: code designation, volt-amperes, amperes and inrush amperes; or amperes and the words "pilot duty";*
 - 3) resistance: amperes, resistance, only;*
 - 4) resistive heating: amperes, resistive heating;*
 - 5) incandescent lamp: amperes or watts, tungsten;*
 - 6) ballast (electric discharge lamp): amperes, ballast;*
 - 7) ballast, electronic (electric discharge lamp): amperes, electronic fluorescent ballast;*
 - 8) motor: horsepower or full-load current and locked-rotor current;*
 - 9) a device intended for control of a specific load type not addressed above shall be marked to indicate the specific load type in standard terminology;*
- dd) a device which is intended for use with a specific model load (e.g. specific motor or coil) or input sourcing device (e.g. specific transducer or power supply) shall be documented with the manufacturer's name and model number of the device with which it is intended to be used.*

5.4.3 Equipment installation

Addition:

Add the following new item:

- aa) OPEN EQUIPMENT: If the control equipment is evaluated in accordance with 9.1.c) and 9.3.2 for hazards related to the spread of fire (containment of fire within the equipment, if it occurs), it can be necessary for the installation documentation to specify necessary constructional requirements applicable for the end use location, for example acceptable ventilation openings, as applicable.*

NOTE 101 See also 7.1.101, 8.1.101 and 9.3.2.

NOTE 102 Subclause 9.1 states that it is possible for different circuits or parts of the equipment to be evaluated to different methods (9.1 a), b) or c)).

Modification:

Replace item d)1) with the following:

- d) 1) supply and FIELD WIRING requirements, for example insulation, temperature RATING;*

5.4.4 Equipment operation

Modification:

Replace item j) with the following:

- j) details of methods of reducing the RISKS of burns from surfaces permitted to exceed the temperature limits of 10.1, Table 19.

6 Protection against electric shock

IEC 61010-1:2010, Clause 6 and IEC 61010-1:2010/AMD1:2016, Clause 6 apply, except as follows:

6.1.2 Exceptions

Replacement:

Replace the text with the following:

If it is not feasible for operating reasons to prevent the following parts being both ACCESSIBLE and HAZARDOUS LIVE, they are permitted to be ACCESSIBLE to SERVICE PERSONNEL during NORMAL USE while they are HAZARDOUS LIVE:

For example:

- a) parts of lamps and lamp sockets after lamp removal;
- b) parts intended to be replaced by SERVICE PERSONNEL (e.g. batteries) and which can be HAZARDOUS LIVE during the replacement or other SERVICE PERSONNEL action, but only if they are ACCESSIBLE only by means of a TOOL and have a warning marking (see 5.2).

If any of the parts in examples a) and b) receive a charge from an internal capacitor, they shall not be HAZARDOUS LIVE 10 s after interruption of the supply.

If a charge is received from an internal capacitor, conformity is checked by the measurements of 6.3 to establish that the levels of 6.3.1 c) are not exceeded.

6.2.1 General

IEC 61010-1:2010, Subclause 6.2.1 and IEC 61010-1:2010/AMD1:2016, Subclause 6.2.1 are applicable to ENCLOSED EQUIPMENT.

6.2.2 Examination

IEC 61010-1:2010, Subclause 6.2.2 is applicable to ENCLOSED EQUIPMENT.

6.2.3 Openings above parts that are HAZARDOUS LIVE

IEC 61010-1:2010, Subclause 6.2.3 is applicable to ENCLOSED EQUIPMENT.

6.2.4 Openings for pre-set controls

Addition:

Add the following paragraph as a new first paragraph:

IEC 61010-1:2010, Subclause 6.2.4 is applicable to ENCLOSED EQUIPMENT. This subclause applies to SERVICE PERSONNEL only.

Addition:

Add the following subclauses:

6.2.101 Accessibility of INTERFACES, PORTS and TERMINALS

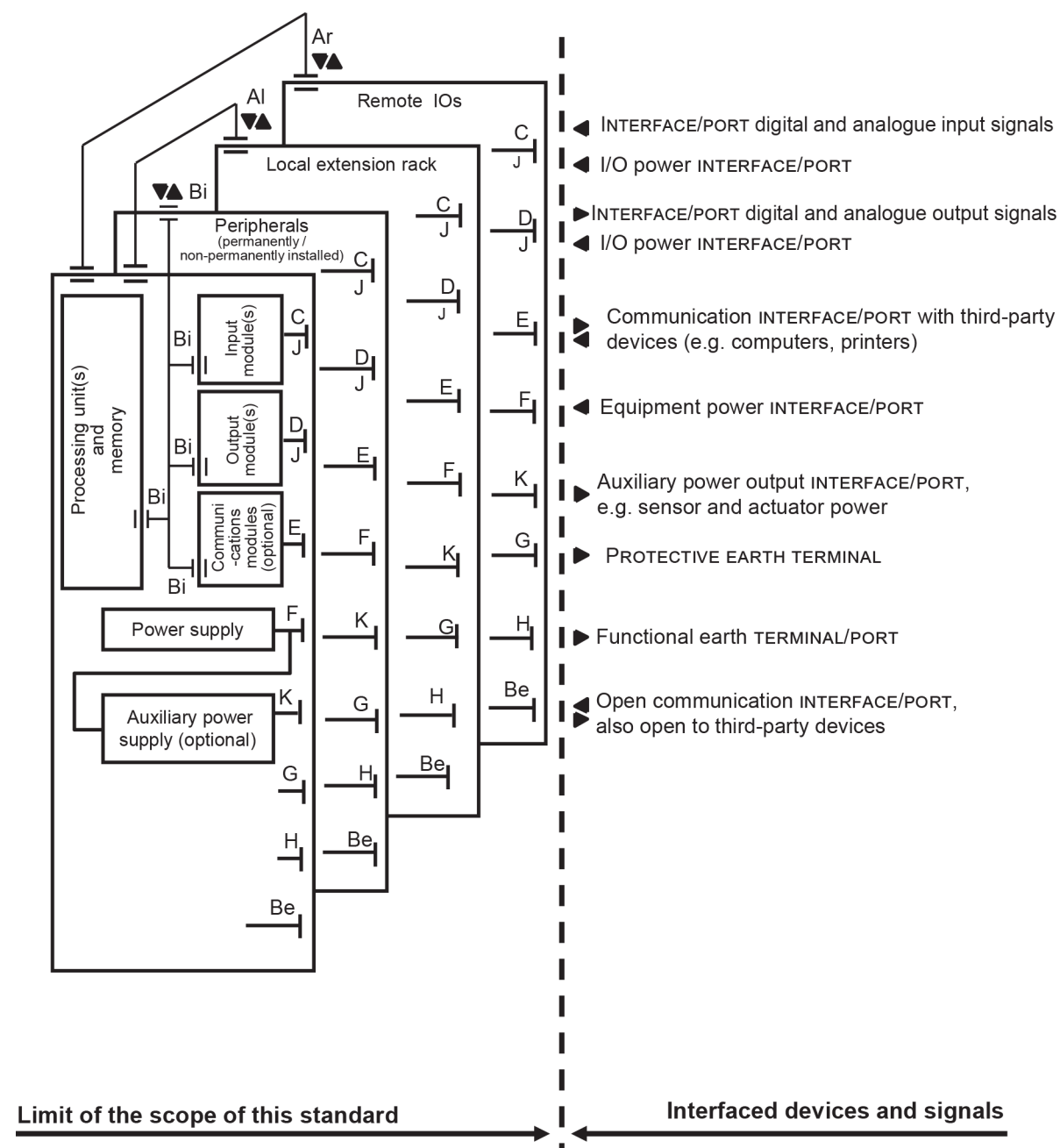
INTERFACES, PORTS and TERMINALS, as listed in Table 101, shall be prevented from becoming both OPERATOR ACCESSIBLE and HAZARDOUS LIVE under normal and single-fault conditions.

Other than for Ports Ar, Be and E, protection can generally be achieved by making the HAZARDOUS LIVE parts, of the INTERFACE, PORT or TERMINAL, not ACCESSIBLE.

See also Figure 101.

**Table 101 – INTERFACES, PORTS AND TERMINALS considered
as OPERATOR ACCESSIBLE for OPEN and ENCLOSED EQUIPMENT**

INTERFACES, PORTS and TERMINALS	Considered as OPERATOR ACCESSIBLE	
	OPEN EQUIPMENT ^c	ENCLOSED EQUIPMENT ^d
Al communication INTERFACE/PORT for local extension rack	No	Yes
Ar communication INTERFACE/PORT for remote devices (e.g. IO station, control network, fieldbus) ^a	Yes	Yes
Be open communication INTERFACE/PORT, also open to third-party devices (e.g. PADT, personal computer used for programming) ^a	Yes	Yes
Bi internal communication INTERFACE/PORT for peripherals	No	Not applicable ^b
C INTERFACE/PORT for digital and analogue input signals	No	Yes
D INTERFACE/PORT for digital and analogue output signals	No	Yes
E serial or parallel communication INTERFACES/PORTS for data communication with third-party devices (e.g. computers and printers) ^a	Yes	Yes
F equipment power input INTERFACE/PORT	No	Yes
G PROTECTIVE EARTH TERMINAL	No	Yes
H FUNCTIONAL EARTH TERMINAL/PORT	No	Yes
J I/O power input INTERFACE/PORT	No	Yes
K auxiliary power output INTERFACE/PORT for external devices (e.g. to supply sensors, actuators, HMI)	No	Yes
<p>NOTE INTERFACE/PORT/TERMINAL designation as used in this table, is aligned with the IEC 61131 series.</p> <p>^a Ports Ar, Be and E contain circuits which may be connected to other equipment, where the remote side of the connecting cable can be ACCESSIBLE, and require therefore to be considered for OPEN EQUIPMENT.</p> <p>^b Port Bi is an internal communication port and thus never leaves the ENCLOSED EQUIPMENT, by definition.</p> <p>^c Depending on the intended use of the connected equipment, INTERFACES/PORTS of OPEN EQUIPMENT shall be considered OPERATOR ACCESSIBLE, when the remote side of the connecting cable or circuit can be ACCESSIBLE.</p> <p>^d Depending on the intended use of the connected equipment, INTERFACES/PORTS of ENCLOSED EQUIPMENT may be considered as not OPERATOR ACCESSIBLE, where the construction of the INTERFACE/PORT and the remote side of the connecting cable or circuit are not ACCESSIBLE.</p>		



IEC

Key

- Al Communication INTERFACE/PORT for local extension rack
- Ar Communication INTERFACE/PORT for remote I/O station, control network, fieldbus
- Be Open communication INTERFACE/PORT, open to third-party devices, e.g. PADT, personal computer used for programming
- Bi Internal communication INTERFACE/PORT, e.g. backplane bus
- C Interface/port for digital and analog input signals
- D Interface/port for digital and analog output signals
- E Serial or parallel communication INTERFACES/PORTS for data communication with third-party devices, e.g. computers, printers
- F Equipment power INTERFACE/PORT
- G PROTECTIVE EARTH TERMINAL/PORT
- H FUNCTIONAL EARTH TERMINAL/PORT
- J I/O power INTERFACE/PORT
- K Auxiliary power output INTERFACE/PORT, e.g. sensor and actuators power

Figure 101 – Typical INTERFACE/PORT of control equipment

Conformity is checked by inspection and in case of doubt by measurement and test in accordance with 6.2 and 6.3.

6.2.102 Control equipment

6.2.102.1 ACCESSIBLE parts

ACCESSIBLE parts of control equipment shall not be, or in the case of a single fault become, HAZARDOUS LIVE. Although these requirements are principally directed at ENCLOSED EQUIPMENT, these requirements also apply to OPEN EQUIPMENT. When applied to OPEN EQUIPMENT, the control equipment shall be considered to be installed in accordance with the installation instructions. Also see 5.4.3 and Annex AA.

If SERVICE PERSONNEL are required to make adjustments, etc., for example during the commissioning of OPEN EQUIPMENT, then protection from HAZARDS in the area near the adjustment shall be provided to prevent contact. If the HAZARD is not indicated by a warning label (see 5.2) then other protective means, for example ENCLOSURE or PROTECTIVE BARRIER is required.

Conformity is checked by inspection and examination in accordance with 6.2.2.

6.2.102.2 SELV/PELV CIRCUITS

SELV/PELV CIRCUITS do not require additional evaluation for RISK against electrical shock, provided that those circuits are in dry locations.

6.5.1 General

Addition:

Add the following subclauses:

6.5.1.101 Classes of equipment or equipment classes

6.5.1.101.1 General

Equipment classes are described to designate the means by which electric shock protection is maintained in NORMAL CONDITION and SINGLE-FAULT CONDITIONS of the equipment.

NOTE Derived from IEC 61140:2016, Clause 7.

6.5.1.101.2 Class I equipment

Class I equipment is equipment in which protection against electric shock is achieved using BASIC INSULATION, and additionally connecting accessible conductive parts to the protective earth conductor.

Class I equipment can have parts with DOUBLE INSULATION or REINFORCED INSULATION or parts operating at safety extra-low voltage.

If a flexible cord is utilized, it shall include a provision for a protective earth conductor that shall be part of the cord set.

ACCESSIBLE conductive parts of equipment, which can become HAZARDOUS LIVE in the event of a single fault, shall be connected to the protective circuit of the equipment. Conductive parts, such as screws, rivets and nameplates, which otherwise could become HAZARDOUS LIVE under single-fault conditions, shall be protected by other means such as DOUBLE/REINFORCED INSULATION so that they do not become HAZARDOUS LIVE.

When a part of the equipment is removed from the ENCLOSURE, for normal maintenance, for example, the protective circuits serving other parts of the equipment shall not be interrupted.

Protective earth requirements are specified in 6.5.2.102 or 6.5.2.103.

6.5.1.101.3 Class II equipment

Class II equipment is equipment in which protection against electric shock does not rely on BASIC INSULATION only, but also on the provision of additional safety precautions, such as DOUBLE INSULATION or REINFORCED INSULATION. There is no provision for protective earth or reliance upon installation conditions.

A PROTECTIVE IMPEDANCE may be used in lieu of DOUBLE or REINFORCED INSULATION.

A means for maintaining the continuity of circuits is acceptable provided that these circuits are double insulated from the ACCESSIBLE circuits of the equipment.

Connection to the earth TERMINALS for functional purposes is acceptable (such as radiofrequency interference suppression) provided the DOUBLE or REINFORCED INSULATION system is still provided for protective purposes.

Equipment shall be of one of the following types:

- a) insulation-encased by a durable and substantially continuous ENCLOSURE of insulating material which envelops all conductive parts. Small parts, such as nameplates, screws and rivets are exempted if they are isolated from HAZARDOUS LIVE parts by insulation at least equivalent to REINFORCED INSULATION;
- b) metal-encased by a substantially continuous metal ENCLOSURE, in which DOUBLE INSULATION is used throughout, except for those parts where REINFORCED INSULATION is used;
- c) combination of a) and b).

NOTE 1 Insulation-encasement can form a part of the whole of the SUPPLEMENTARY INSULATION or of the REINFORCED INSULATION.

NOTE 2 Utilization of DOUBLE INSULATION or REINFORCED INSULATION, or both, throughout, with a PROTECTIVE EARTH TERMINAL or contact, is deemed to be of Class I construction.

NOTE 3 This equipment can have parts operating at safety extra-low voltage.

6.5.1.101.4 Class III equipment

Class III equipment is equipment in which protection against electric shock is provided by circuits supplied by safety extra-low voltage (SELV/PELV). And additionally, the voltages generated by or within the equipment do not exceed the limits for SELV/PELV.

Connection to the earth TERMINALS for functional purposes is acceptable (such as radiofrequency interference suppression).

6.5.2.1 General

Addition:

Add the following note at the end of the first paragraph:

NOTE PROTECTIVE EARTH TERMINALS and earth contacts are not connected directly to the neutral TERMINAL within the equipment. This does not prevent the connection of appropriately RATED devices (such as capacitors or surge suppression devices) between the PROTECTIVE EARTH TERMINAL and neutral.